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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/19/2000

Philippe Guyot-Sionnest

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03/17/2004

GENERAL NUMBER 00757
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EXAMINER

UHLIR, NIKOLAS J

ART UNIT

PAPER NUMBER

1773

DATE MAILED: 03/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/694,090

Applicant(s)

GUYOT-SIONNEST ET AL.

Examiner

Nikolas J. Uhler

Art Unit

1773

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 January 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-33 and 36-42 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 6-15, 17-33 and 36-42 is/are rejected.
- 7) ☒ Claim(s) 5, 15 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

1. This office action is in response to the amendment/request for reconsideration dated January 26, 2004. Currently, claims 1-33 and 26-42 are pending.

Withdrawal of Previous Rejection

2. The applicant's arguments with respect to the previous 112 first paragraph rejection of claims 1-33 and 36-42 for failing to comply with the written description requirement are hereby withdrawn. First, applicants amendment to require that the carrier or hole "is" in a quantum confined state at room temperature and in the absence of an applied electric field clearly overcomes the portion of the previous rejection relating to the requirement that the carrier "remains" in a quantum confined state at room temperature in absence of an applied electric potential. Second, the examiner has reconsidered the requirement "in the absence of an applied electric potential" and now believes that the instant specification does provide support for such a limitation. Specifically, beginning on page 6 of the specification, the applicant discusses various methodologies by which the semiconductor nanocrystals may be doped. These methods include chemical doping (i.e. by exposing the nanocrystal to an oxidizing or reducing agent), electrochemical doping (applying an electric potential to a colloid of semiconductor nanocrystals and an electrolyte), or photo doping (inducing charge separation by a photochemical reaction). By differentiating between chemical doping via an oxidation/reduction reaction and electrochemical doping with an electric potential, applicant has support for methodologies wherein semiconductor nanocrystals have carriers in quantum confined states in the absences of an applied electric potential. The

Art Unit: 1773

chemical doping via an oxidation/reduction reaction will generate an electric potential that can be measured. However, this potential is internally generated and thus is not an "applied" electric potential.

3. Thus, as both reasons for rejection claims 1-33 and 36-42 under 112 second paragraph for failure to meet the written description requirement have been overcome, this rejection is hereby withdrawn.

Claim Rejections - 35 USC § 112

4. Claims 1-4, 6-15, 17-33 and 36-42 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

5. As written, claims 1 and 10, upon which all of the other claims are dependent, require a semiconductor nanocrystal (and in the case of claim 10 a method for making a semiconductor nanocrystal) that has been doped with carrier selected from an electron or a hole, such that the carrier is in a quantum confined state at room temperature and in the absence of an applied electric potential.

6. There are many factors to be considered when determining whether there is sufficient evidence to support a determination that a disclosure does not satisfy the enablement requirement and whether any experimentation necessary is "undue." These factors include, but are not limited to: 1. The breadth of the claims. 2. The nature of the invention. 3. The state of the prior art. 4. The level of one of ordinary skill. 5. The level of

Art Unit: 1773

predictability in the art. 6. The amount of direction provided by the inventor. 7. The existence of working examples. And 8. The quantity of experimentation needed to make or use the invention based on the content of the disclosure. See MPEP 2164.01(a).

7. As written, claims 1 and 10 are considered by the examiner to be broad, as they encompass "any" doped semiconductor nanocrystal that can be doped with an electron or a hole such that the electron or hole is in a quantum confined state at room temperature and in the absence of an applied electric potential. Further, dependant claims 4 and 15 require the semiconductor nanocrystal to be a 2-6 semiconductor compound, which is also considered by the examiner to be a very broad class of semiconductors.

8. Regarding the level of one ordinary skill, level of predictability in the art, the guidance provided by the applicant, and the working examples factors. MPEP 2164.05(b) states, "The relative skill of those in the art refers to the skill of those in the art in relation to the subject matter to which the claimed invention pertains at the time the application was filed." MPEP 2164.02 states "The specification need not contain an example if the invention is otherwise disclosed in such a manner that one skilled in the art will be able to practice it without undue experimentation.... Lack of a working example, however, is a factor to be considered, especially in a case involving unpredictable and undeveloped art." MPEP 2164.03 states, "The amount of guidance or direction needed to enable the invention is inversely related to the amount of knowledge in the state of the art, as well as the predictability in the art. The amount of guidance or direction refers to that information in the application as originally filed that teaches

Art Unit: 1773

exactly how to make or use the invention. The predictability or lack thereof in the art refers to the ability of one skilled in the art to extrapolate the disclosed or known results to the claimed invention."

9. The level of one of ordinary skill in the art of semiconductor doping is considered by the examiner to be high, as the technology and methodology for doping *bulk* semiconductor materials has been known for some time. The doping of semiconductor nanocrystals is a largely undeveloped art, and it is not clear from the prior art which materials and methodologies provide the necessary means for achieving a desired goal. Therefore, it is the examiners position that the level of unpredictability in the art of semiconductor *nanocrystal* doping is high. Although the applicant in the instant specification provides a quite thorough disclosure of the material properties exhibited by the claimed invention, in regards to actual materials that exhibit these properties the specification only really shows that the materials CdSe, CdS, and ZnS exhibit the disclosed properties, and as shown by figure 3, even these materials are not capable of maintaining these properties indefinitely at the claimed conditions (room temperature and no applied electric potential. The applicant has indicated in the instant specification that semiconductor nanocrystals can be made from a wide variety of materials, which the examiner does not question. However, in light of the fact that the art is largely undeveloped and thus unpredictable, one with ordinary skill in the art would not be able to determine from this one example what materials other than CdSe, CdS, and ZnO meet the material properties of the claimed invention without undue experimentation.

Art Unit: 1773

10. The applicant is referred to MPEP 2164.01(b) which states, "As long as the specification discloses at least one method for making and using the claimed invention that bears a reasonable correlation to the entire scope of the claim, then the enablement requirement under 35 U.S.C 112 is satisfied." In this case, the specification does not provide at least one method for making and using the invention that bears a **reasonable correlation to the entire scope of claims 1-4, 6-15, 17-33 and 36-42.**

Rather, the specification only provides enablement for CdSe, CdS, and ZnO, as being able to be doped with a carrier selected from an electron and a hole, such that the carrier remains in a quantum confined state at room temperature and in the absence of an applied electric potential, when "remains in a quantum confined state" is construed in terms of minutes or hours.

Allowable Subject Matter

11. Claims 5 and 15 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

12. The following is a statement of reasons for the indication of allowable subject matter: Claims 5 and 15 require a doped semiconductor nanocrystal that is doped with a carrier selected from the group consisting of an electron or a hole, wherein the carrier is in a quantum confined state in the absence of an applied electric potential and at room temperature, wherein the semiconductor nanocrystal is selected from ZnO, CdSe, and CdS. There is no valid prior art that teaches or renders obvious this combination of limitations.

Response to Arguments

13. Applicant's arguments filed 1/26/2004 have been fully considered but they are not persuasive. The entirety of applicant's arguments with respect to the 112 first paragraph rejection of claims 1-33 and 36-43 for failure to comply with the written description requirement are moot in view of the fact that this rejection has been withdrawn.

14. With respect to the 112 first paragraph rejection of claims 1-33 and 36-43 for failure to comply with the enablement requirement, the applicant has submitted a declaration stating that he believes the method disclosed in the instant application for forming doped nanocrystals exhibiting the claimed properties extends to many types of nanocrystals and is not limited to CdSe, CdS, ZnO, or even 2-6 semiconductors in general. The examiner does not question whether the method disclosed by the applicant in the specification extends to other types of semiconductor compounds. The issue that the examiner takes with the claim language is that it claims "every" type of semiconductor compound that is known or may become known. As evidenced by the applicant's own data (see the inserts to figure 3), the length of time that a carrier may exist in a quantum confined state is strongly material dependent. This raises substantial doubt in the examiners mind as to whether each and every type of semiconductor nanocrystal can be doped with a quantum confined carrier at room temperature and in the absence of an applied electric field. Applicant's declaration does nothing more then to show that two other types of semiconductor nanocrystals (PbSe and InP) can be doped with a quantum-confined carrier by the applicant's method. The declaration does

Art Unit: 1773

not provide any basis by which the examiner can conclusively say that the applicant's method will work for every semiconductor compound. Indeed, applicant's claims are not even limited to doped semiconductor nanocrystals produced by the applicant's method.

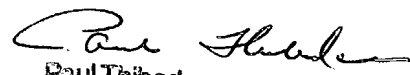
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nikolas J. Uhler whose telephone number is 571-272-1517. The examiner can normally be reached on Mon-Fri 7:30 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul J. Thibodeau can be reached on 571-272-1516. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


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